

## **Air Compliance Branch Visible Emissions Evaluations (VEEs)**

### **Standard Operating Procedure (SOP)**



**Office:** Office of Air Quality

**Branch:** Air Compliance

**Section:** Air Compliance Section I, Air Compliance Section II, Regional Office Air Compliance staff, and Compliance Data Section

**Creation date:**

**Revision #:** 0

**Revised:** N/A

**Review/ Revision cycle:** 2 Years

**Effective date:** April 30, 2007

#### **Scope of operations**

This Standard Operating Procedure (SOP) is to be used by the Air Compliance Branch and Regional Offices to observe visible emissions during inspections, surveillance, and stack test observations to determine compliance with opacity limitations. This policy outlines the requirements and qualifications needed to perform Visible Emissions Evaluations (VEEs). It also describes the process for determining if VEEs should be performed during inspections, surveillance, or stack test observations.

#### **Scope of applicability**

This SOP is intended for field staff in the Air Compliance Branch and Regional Offices who perform VEEs as part of the inspection process, surveillance, or during stack test observations.


## Approvals

I approve and authorize this Standard Operating Procedure:

### Branch Chief

Phil Perry

Signed



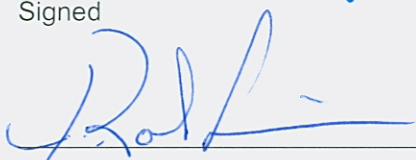
Date

4/19/07

### Deputy Director-NWRO

J. Robert Simmons

Signed



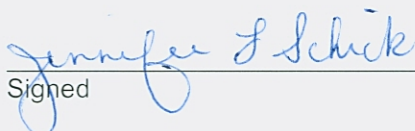
Date

4/12/07

### Section QA Contact

Jennifer Schick

Signed



Date

4/16/07

### Branch QA Coordinator

Roger Letterman

Signed



Date

4/16/07

### Originator

Michael Hall

Signed



Date

4/12/07

This Standard Operating Procedure is consistent with agency requirements.



Indiana Department of Environmental Management  
Quality Assurance Program  
Planning and Assessment

Date

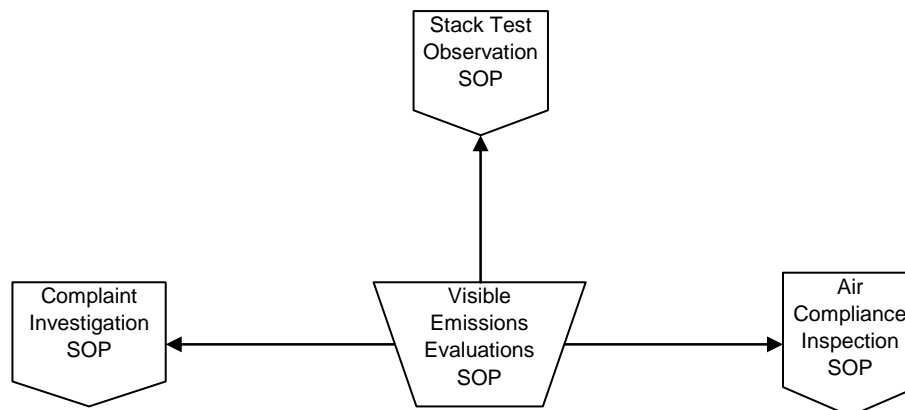
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## 1. Overview work flow chart:

VEEs can be one part of an inspection used to determine compliance, as part of a stack test observation or be performed independently to determine compliance of an opacity standard.



## 2. Definitions:

- **Field Staff:** Employees identified as responsible for performing routine duties which require field work outside of the assigned work station or office. Field staff includes inspectors and stack test observers.
- **Opacity:** The amount of light obscurity caused by visible emissions emitted by or from a unit, facility, or source. The visible emissions shall not include condensed water vapor.
- **Qualified Observer** - staff certified in accordance with 40 CFR Part 60, Appendix A-4, Method 9.
- **Visible Emissions (VE):** A discharge into the atmosphere which can be seen by the naked eye that exits a stack in the form of a plume is generated by vehicular traffic; or is involved with material processing, handling, storage, or transfer operations.
- **Visible Emissions Evaluations (VEEs):** Act of observing and placing numeric values to emissions in order to determine opacity compliance by a qualified observer in accordance with 40 CFR 60, Appendix A-4, Method 9 or Method 22.
- **VEE form:** standardized template used by the Air Compliance Branch and Regional Offices to document VE observations.

## 3. Roles:

Role Title	# of Staff	Experience	Qualification & Training	Location
Air Compliance Inspectors/ Stack Test Observers	App. 40	3-6 months of on field experience	Smoke School and U.S. EPA Reference Method 9 certification	Air Compliance Branch and Regional Offices
Branch QA Contact	1	N/A	N/A	Air Compliance Branch
Section QA Contact	1	N/A	N/A	Air Compliance Branch
Deputy Director	3	N/A	N/A	Regional Offices
Air Compliance Section Chiefs	3	N/A	N/A	Air Compliance Sections
Branch Chief	1	N/A	N/A	Air Compliance Branch

Compliance Inspectors/  
Stack Test Observers

-follow procedure in SOP to ensure objectivity and accuracy when performing VEEs.

Branch QA Contact - reviews and approves SOP.

Section QA Contact - reviews and approves SOP.

Deputy Director - initial review and approval of SOP and implementation of SOP with regional staff. Ensures all field staff are trained and certified as qualified observers. Reviews and approves/disapproves field generated observations.

Section Chief -reviews and approves SOP. Ensures all field staff are trained and certified as qualified observers. Reviews and approves VEE forms. Reviews and approves/disapproves field generated observations.

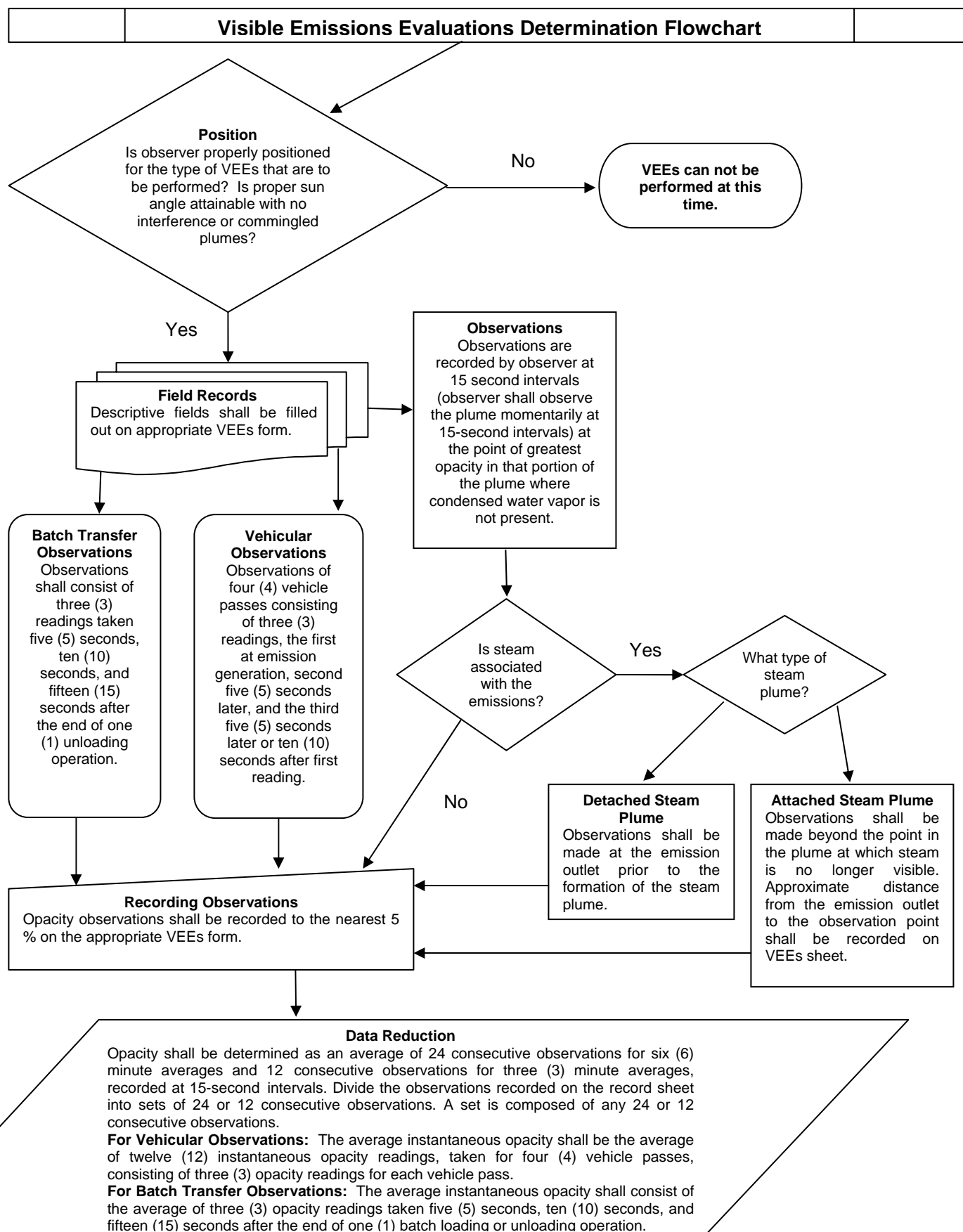
Branch Chief - reviews and approves SOP.

#### 4. Description of equipment, forms, and/or software to be used:

Equipment, Form, &/or Software	Who Uses It?	Where to Find It
VEE form	Field Staff	S:\IGCN\OAM\COMMON\Air Compliance\Forms\
Stopwatch/Time piece with second hand	Field Staff	Issued to field staff (see supervisor for supplies)
Calculator	Field Staff	Issued to field staff (see supervisor for supplies)
Clipboard	Field Staff	Issued to field staff (see supervisor for supplies)
Writing Utensils	Field Staff	Issued to field staff (see supervisor for supplies)

#### 5. Procedure

##### 5.1 Procedural Flowchart: (see next page)



## 5.2 Procedure:

The qualified observer shall use the following procedures for visually determining the opacity of emissions.

### 1. Arrive on-site.

- If the VEEs are part of a stack test observation, an on-site compliance inspection, or complaint investigation the qualified observer should check in with the designated plant representative
- If the VEEs are part of a surveillance or complaint investigation, the qualified observer should not enter the site and take a position off-site.
- In addition, the observer shall initially use 40 CFR 60 Appendix A-4, Method 22 to determine if emissions are present and allowable (i.e. There shall be a zero percent (0%) frequency of visible emission observations from a building enclosing all or a part of the material processing equipment except from a vent in the building and there shall be a zero percent (0%) frequency of visible emission observations of a material during the in plant transportation of material by truck or rail at any time. Material transported by truck or rail that is enclosed and covered shall be considered in compliance with the in plant transportation requirement). A VEE shall be taken on any unit or facility when any visible emissions are noted (generally >5% opacity).
- The observer shall also assess whether or not any visible emissions qualify as fugitive dust per 326 IAC 6-4.

**2. Position:** The qualified observer should move into position consistent with 40 CFR 60, Appendix A-4, Method 9 and Method 22 to take a VEE evaluation. The position will depend on the type of observation as follows:

- Standard VEs –
  1. Stacks, vents, roof monitors, etc. - The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his/her observations from a position such that his line of vision is approximately perpendicular to the plume direction and, when observing opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).
  2. Building openings, parking areas, roads, etc. - The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his/her observations from a position such that his line of vision is approximately perpendicular to the plume direction and, when observing opacity of emissions. The observer's line of sight should not include more than one plume at a time. The qualified observer shall stand approximately fifteen (15) feet from the plume and at approximately right angles to the plume shall stand at a distance sufficient to provide a clear view of the

emissions. Fugitive dust should generally be documented using 40 CFR 60 Appendix A-4, Method 22.

- Vehicular Traffic VEs subject to Opacity Limitations -
  1. The qualified observer shall stand approximately fifteen (15) feet from the plume and at approximately right angles to the plume. Each reading shall be taken approximately four (4) feet above the surface of the roadway or parking area.
  2. Observations for compliance
- Batch Transfer VEs subject to Opacity Limitations - The qualified observer shall stand approximately fifteen (15) feet from the plume and at approximately right angles to the plume.

If the qualified observer cannot get properly positioned for the type of VEE to be performed or if it is not possible to attain the proper sun angle without interference or commingled plumes, valid VEEs cannot be performed. Qualified observers staff should make every attempt to take valid VEEs. However, if any visible emission is observed, the visible emission should be documented either on a VEE form and note that the readings were not valid due to a particular reason or noted in an inspection or observation report estimating the visible emissions.

**3. Field Records:** The qualified observer shall record the name of the plant, emission location, facility type, observer's name and affiliation, and the date on a VEE Form (Appendix A, B, or C or D). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

**4. Perform VE Observations:** Once the qualified observer is in position, VE observations should be performed as follows:

Standard Observations: Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume but instead shall observe the plume momentarily at 15-second intervals. The following applies when observing steam plumes:

- **Attached Steam Plumes:** When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.
- **Detached Steam Plume:** When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

VE observations should be taken for a minimum of 15 minutes (60 readings).

Vehicular Traffic Observations subject to Opacity Limitations: The average instantaneous opacity shall be the average of twelve (12) instantaneous opacity readings, taken for four (4)



vehicle passes, consisting of three (3) opacity readings for each vehicle pass. The three (3) opacity readings for each vehicle pass shall be taken as follows:

- A. The first will be taken at the time of emission generation.
  - B. The second will be taken five (5) seconds later.
  - C. The third will be taken five (5) seconds later or ten (10) seconds after the first.
- The three (3) readings shall be taken at the point of maximum opacity.

Batch Transfer Observations subject to Opacity Limitations: The average instantaneous opacity shall consist of the average of three (3) opacity readings taken five (5) seconds, ten (10) seconds, and fifteen (15) seconds after the end of one (1) batch loading or unloading operation. The three (3) readings shall be taken at the point of maximum opacity.

## **5. Recording Observations:**

Opacity observations shall be recorded to the nearest five (5) percent on a VEE Form. VE observations should be taken for a minimum of 15 minutes (sixty (60) readings) for stack observations, twelve (12) readings for vehicle observations and three (3) readings for batch operations. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second or 5-second period.

## **6. Data Reduction:**

Standard VEEs - Opacity shall be determined as an average of twenty-four (24) consecutive observations for six (6) minute averages and twelve (12) consecutive observations for three (3) minute averages, recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of twenty-four (24) or twelve (12) consecutive observations. A set is composed of any twenty-four (24) or twelve (12) consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of twenty-four (24) or twelve (12) observations, calculate the average by summing the opacity of the twenty-four (24) or twelve (12) observations and dividing this sum by twenty-four (24) or twelve (12) respectively. If an applicable standard specifies an averaging time requiring more than twenty-four (24) observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet.

Vehicular Traffic VEEs - The average instantaneous opacity shall be the average of twelve (12) instantaneous opacity readings, taken for four (4) vehicle passes, consisting of three (3) opacity readings for each vehicle pass.

Batch Transfer VEEs - The average instantaneous opacity shall consist of the average of three (3) opacity readings.

## **6. Standards and checklists:**

- A. Standard VEE form for six minute and three minute average limitations (also may be used for the documentation of instantaneous opacity limits).
- B. Vehicular Traffic VEEs form for emissions caused by vehicular traffic.
- C. Batch Loading VEE form for emissions caused by batch loading operations.

## **7. Records Management**

Completed VEEs forms shall be retained in accordance with the Office of Air Quality's Records Retention and Disposition Schedule.

## **8. Quality Assurance / Quality Control**

Prior to leaving the site of observation, all information on the VEEs form shall be reviewed and filled in with the appropriate information. VEEs shall be included in the inspection or observation report packet and reviewed by the designated supervisor for adequate content and correct calculations prior to being filed, having a violation letter issued or being referred to the Office of Enforcement.

## **9. Continuous Improvement Cycle**

This section is not applicable to the VEE process.

## **10. References**

40 CFR 60, Appendix A-4, Methods 9 & 22  
40 CFR 60 (§60.1 to End)  
40 CFR 61  
40 CFR 63  
326 IAC 5  
326 IAC 6  
Office of Air Quality's Records Retention and Disposition Schedule.

## **11. History of Revisions**

N/A.

## **12. Appendices**

- A. Standard VEE form for six minute and three minute average limitations (also may be used for the documentation of instantaneous opacity limits).
- B. Vehicular Traffic VEE form for emissions caused by vehicular traffic.
- C. Batch Loading VEE form for emissions caused by batch loading operations.

## Appendix A

Standard VEE form for six minute and three minute average limitations  
(also may be used for the documentation of instantaneous opacity limits)

### Indiana Department of Environmental Management Office of Air Quality Visible Emissions Evaluation Form

Source: \_\_\_\_\_  
County: \_\_\_\_\_  
Location: \_\_\_\_\_  
Facility Observed: \_\_\_\_\_

Date: \_\_\_\_\_  
Start Time: \_\_\_\_\_  
Stop Time: \_\_\_\_\_

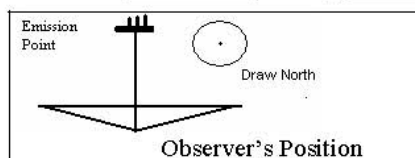
Observer's Name: \_\_\_\_\_  
Certification Date: \_\_\_\_\_

#### Emission Point Information

Type: \_\_\_\_\_  
Est. Height: \_\_\_\_\_  
Est. Distance to Source: \_\_\_\_\_  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Emission Color: \_\_\_\_\_  
If attached steam plume, show  
distance from outlet to  
observation point: \_\_\_\_\_

#### Reading Conditions

Approx. Wind Direction  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Est. Wind Speed:  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Sky Condition  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Color of Clouds  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Sky Color  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Plume Background/Color  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_



OPACITY LIMIT: \_\_\_\_\_  
per 326 IAC \_\_\_\_\_  
per Permit No. \_\_\_\_\_  
per Agreed Order No. \_\_\_\_\_  
per NSPS \_\_\_\_\_

	0	15	30	45
0				
1				
2				
3				
4				
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	0	15	30	45
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58				
59				

Average Opacity: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_  
4) \_\_\_\_\_ 5) \_\_\_\_\_ 6) \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Appendix B

### Vehicular Traffic VEE form for emissions caused by vehicular traffic

### Indiana Department of Environmental Management Office of Air Quality Visible Emissions Evaluation Form

Source: \_\_\_\_\_  
 County: \_\_\_\_\_  
 Location: \_\_\_\_\_

Date: \_\_\_\_\_  
 Start Time: \_\_\_\_\_  
 Stop Time: \_\_\_\_\_

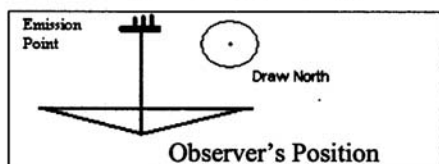
Observer's Name: \_\_\_\_\_  
 Certification Date: \_\_\_\_\_

#### Emission Point Information

Type: Vehicular  
 Est. Height: \_\_\_\_\_  
 Est. Distance to Source: \_\_\_\_\_  
 Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
 Emission Color: \_\_\_\_\_

#### Reading Conditions

Approx. Wind Direction  
 Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
 Est. Wind Speed:  
 Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
 Sky Condition  
 Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
 Color of Clouds  
 Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
 Sky Color  
 Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
 Plume Background/Color  
 Start: \_\_\_\_\_ Stop: \_\_\_\_\_



OPACITY LIMIT: \_\_\_\_\_  
 per 326 IAC \_\_\_\_\_  
 per Permit No. \_\_\_\_\_  
 per Agreed Order No. \_\_\_\_\_  
 Per NSPS \_\_\_\_\_

#### Vehicular Readings

Total of twelve (12) opacity readings for four (4) vehicle passes = $\frac{\text{total}}{12} = \%$				
Avg. Instantaneous Opacity = $\frac{\text{readings for four (4) vehicle passes}}{12} = \%$				
Road Name/ID: _____				
_____ Paved          _____ Unpaved				
Vehicle #1:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
Vehicle #2:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
Vehicle #3:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
Vehicle #4:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
				Total = _____ % 12
Road Name/ID: _____				
_____ Paved          _____ Unpaved				
Vehicle #1:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
Vehicle #2:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
Vehicle #3:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
Vehicle #4:	Time _____	Initial _____	5 sec. _____	10 sec. _____
				Total _____
				Total = _____ % 12

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# Appendix C Batch Loading VEE form for emissions caused by batch loading operations

## Indiana Department of Environmental Management Office of Air Quality Visible Emissions Evaluation Form

Source: \_\_\_\_\_  
County: \_\_\_\_\_  
Location: \_\_\_\_\_

Date: \_\_\_\_\_  
Start Time: \_\_\_\_\_  
Stop Time: \_\_\_\_\_

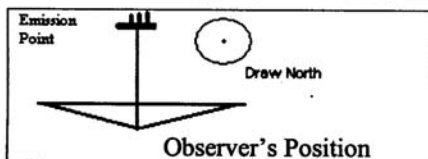
Observer's Name: \_\_\_\_\_  
Certification Date: \_\_\_\_\_

### Emission Point Information

Type: Batch Transfer \_\_\_\_\_  
Est. Height: \_\_\_\_\_  
Est. Distance to Source: \_\_\_\_\_  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Emission Color: \_\_\_\_\_  
If attached steam plume, show  
distance from outlet to  
observation point: \_\_\_\_\_

### Reading Conditions

Approx. Wind Direction  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Est. Wind Speed:  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Sky Condition  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Color of Clouds  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Sky Color  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_  
Plume Background/Color  
Start: \_\_\_\_\_ Stop: \_\_\_\_\_



OPACITY LIMIT: \_\_\_\_\_  
per 326 IAC \_\_\_\_\_  
per Permit No. \_\_\_\_\_  
per Agreed Order No. \_\_\_\_\_  
Per NSPS \_\_\_\_\_

Batch Transfer Readings				
Batch Load #1:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____
Batch Load #2:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____
Batch Load #3:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____
Batch Load #4:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____
Batch Load #5:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____
Batch Load #6:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____
Batch Load #7:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____
Batch Load #8:				
Time _____	5 sec. _____	10 sec. _____	15 sec. _____	Average _____

Facility Observed: \_\_\_\_\_  
Material Type: \_\_\_\_\_

Average Opacity: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_  
4) \_\_\_\_\_ 5) \_\_\_\_\_ 6) \_\_\_\_\_  
7) \_\_\_\_\_ 8) \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_